

## Where Do Comets Come From?

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The source of the long-period comets, such as Hale-Bopp and Hyakutake, is the Oort cloud, a vast cloud of some  $10^{12}$  comets surrounding the solar system and extending to interstellar distances (Oort, 1950; for a recent review see Weissman, 1996). It is now widely accepted that the Oort cloud comets did not form *in situ* but rather were ejected from the giant planets zone during the final clearing of icy planetesimals from that region (Kuiper, 1951). New dynamical simulations show how this may have happened (Dones et al., BAAS, in press, 2000). Our model results suggest that  $\sim 5\%$  of planetesimals ejected from the giant planets zone are captured into the Oort cloud and survive after 4 Gyr, the rest being ejected to interstellar space. These proto-comets originate throughout the giant planets region, not just in the Uranus-Neptune zone, as previously thought. However, the purely dynamical simulation presented here ignores the collisional history of the planetesimals during the ejection process. The planetesimal disk in the giant planets zone is optically thick to collisions (assuming a collisionally evolved size distribution between radii of 1 cm and 100 km), and typical cometary size bodies of a few kilometers radius will be eroded away on timescales shorter than their dynamical ejection times (Stern et al., BAAS, in press, 2000). Possible solutions to this apparent contradiction will be discussed. This paper is dedicated to the memory of Prof. William Kaula. This work was supported by the NASA Origins and PG&G Programs.

References: Kuiper, G. (1951) In *Astrophysics*, ed. J. Hynek, pp. 357-424. Oort, J. (1950) Bull. Astron. Inst. Neth. **11**, 259. Weissman, P. (1996) In *Completing the Inventory of the Solar System*, eds. T. W. Rettig and J. M. Hahn, ppm. 265-288.